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AUTHOR Tuinman, J. Jaap  
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### ABSTRACT

Studies showing that even though certain factual questions are directly related to information in passages they are also easier to answer without reference to the passage are the basis for this study which attempted to define qualities of relationship which might be responsible for the ease of answerability. Three Tests of Acquisition of Information (TAI) composed of paragraphs and multiple-choice items were designed, including a phantasy test (TAI--P), a lexical substitution test (TAI--LS) in which a key word was replaced by an artificial word, and a semantic anomaly test (TAI--SA) in which relationships were distorted by manipulations of parts of speech. Reliabilities were obtained by using a sample of approximately 750 junior-high-school students. In addition, the experimental tests and a reading subtest of the Sequential Tests of Educational Progress (STEP) were administered to 240 junior-high-school students, half of whom read the paragraphs and answered the questions and the other half answered only the questions. Items judged for passage relatedness were analyzed using two-way analysis of variance procedures. Results indicated that TAI--P, STEP, and TAI--LS items did not differ significantly in either the passage or nonpassage conditions, while the TAI--SA test items did. References, tables, and sample test items are included. (MS)

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## PASSAGE-RELATED READING COMPREHENSION QUESTIONS

J. Jaap Tuinman

Reading Program

Institute for Child Study

Indiana University

When questions about a reading passage can be answered by a subject who has not read the passage, doubt may arise about the validity of those questions as estimators of how well that student can read.

Preston (1964), Weaver and Bickley (1967), Bickley, Weaver and Ford (1968), Weaver, Bickley and Ford (1969) and Mitchell (1967) have shown that a large number of test items in commercial reading tests is characterized by very low passage-relatedness. That is, the expected mean score for subjects taking those tests without the reading passages present exceeds considerably the mean score expected on the basis of chance only.

A question of interest is, which item characteristics control the degree of item answerability under the passage-out condition, i.e. its passage-relatedness. Weaver c.s. contend that the more factual items are less passage related. These items were in their studies relatively easy even under the passage-out condition. Since factual items generally are thought of as those items which are directly answerable from the text, something of a paradox arises if the above contention is true: the more passage-related items (by one criterion) are the less passage-related items (by another criterion).

In the present study the writer explored this paradox, referred to as "Weaver's paradox", somewhat further. In the first phase of the study three experimental tests containing 40 four foil multiple choice

items each, were developed. (Appendix) The tests differed in the format of the passages on which the items were based. The Test of Acquisition of Information--Phantasy (TAI--P) contained phantasy stories of a science-fiction type, written by the author. The TAI--Lexical Substitutions (TAI--LS) consisted of passages in which a key word governing the interpretation of the passage was removed and replaced by an artificial word. The TAI--Semantic Anomaly (TAI--SA) contained passages in which normal relationships among "events" had been distorted by manipulation of parts of speech. The passages kept their syntactic integrity, however. After repeated tryouts, involving a sample of approx. 750 junior high school students, relatively high reliabilities were obtained. (KR-20's between .82 and .87).

In the second phase of the study these tests were administered, together with a number of factor markers, to a sample of 240 7th, 8th, and 9th graders. In addition, a subset of 40 items from the STEP reading test, form 3A, was administered. This repeated measure design allowed an in depth analysis of the relationships among the four reading measures, employing factor analysis. The results of this part of the study will be reported elsewhere. (Tuinman, 1970; Tuinman, Weaver, and Dekle, 1971).

Prior to the second phase test administration, the items from the experimental tests and from the STEP had been rated by five judges on a four point scale indicating the degree to which each item could be answered directly from the passage. (Mean reliability of the summed ratings was .77). On basis of these ratings each test could be divided into three subtests of 10 items, with exclusion of the 10 items closest to the mean of the rating scale. These subtests were labelled "item-type"

subtests. The issue of passage-relatedness of the items was studied by sampling from the entire body of data in such a fashion that a 2 x 3 complete factorial design resulted. Factor A, passage condition, had two levels (passage-in; passage out); Factor B, item-type, had as its three levels: highly directly answerable from the passage, moderately directly and highly indirectly. The results for each of the tests were analyzed separately because of the difficulty of the raters to keep their interpretation of the concept "directly answerable" invariant across the different passage formats. The present paper reports on this phase of the study. (See tables 1 and 2.)

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Insert tables 1 and 2 here

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The data were analyzed by means of two-way Anova's and subsequent Scheffe Multiple Comparisons.

The results did not substantiate Weaver's paradox unequivocally. The TAI--P and the STEP subset featured normal prose, matching that of the tests analyzed by Weaver et al. For these tests it was expected that the items directly derived from the passages would be easiest. However, no significant differences among these subtests were found under the no-passage condition. The same was true for the TAI-LS items.

The results of the TAI--Semantic Anomaly, on the other hand, suggest a modification of the contention of Weaver c.s. that factualness is the key word to explaining passage-relatedness. For this test, the items most directly answerable from the passage, were decidedly the most difficult under the passage-out condition. ( $p < .01$ ) The following interpretation of these results is suggested.

When a subject is reading an item, a structure of expectancies is generated. Those expectancies are based, at least in part, upon the experienced relationship among "events" implied in the question. Normal prose rewards such expectancies in the sense that its content largely coincides with them; this reduces the need of reading as a source of information for the answering of those items. It seems reasonable to expect that the type of question which is normally relatively easy becomes the type of question which is relatively hard, when the criterion for correctness is changed to the extent that the answers generated by the normal structure of expectancies are wrong and vice versa.

The TAI--SA contained many items which were highly factual, and which could be answered by means of a direct referral to the text. Yet, in the case of these tests, those items were very hard to answer when the passage was removed. They displayed the characteristics of the items called "inferential items" by Weaver et al. It seems that factual items based on regular prose are easy under the passage-out condition, not because they refer to facts, nor because they were derived directly from the passage, but because such items generate a structure of expectancies which are rewarded by the passage. This very function seems to interfere with the measurement of the actual control of the reading passage over the item-answering behavior of the readers.

In order to measure the extent to which a subject does and can read, in some situations items seem to be required which exclude all sources of information but the reading passage itself. In the course of the research reported here, passage formats have been developed

which drastically reduced the proportion of items answered under the passage-out condition. (E.g., for the TAI--SA the mean score was 8.01, as opposed to 13.66 for the STEP items, under the passage-out condition. Both tests had 40 items each and comparable means under the passage-in condition.) The data treated in the present paper allow a further refined understanding of which characteristics determine answerability of items based on prose passages. It is believed that this understanding has practical implications for the development of more adequate measures of the acquisition of information from reading passages--a behavior which is taken to be a part of the set of behaviors of which reading comprehension is comprised. (Carroll, 1968)

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Table 1

Means and Standard Deviations for  
the Item-type Subtests under Two Paragraph Conditions

Paragraph	Present			Absent		
	Test	Sub Test	$\bar{X}$	S.D.	$\bar{X}$	S.D.
TAI-P	1		6.40	2.42	3.18	1.24
	2		5.48	2.49	2.56	1.26
	3		5.28	2.23	2.02	1.17
TAI-LS	1		5.78	2.20	3.03	1.48
	2		5.55	1.88	2.93	1.42
	3		6.08	2.26	3.40	1.24
TAI-SA	1		5.20	2.39	1.08	.99
	2		5.93	2.39	2.03	.99
	3		5.20	2.40	2.95	1.55
STEP-40	1		6.58	1.73	3.58	1.48
	2		3.98	1.74	3.30	1.27
	3		4.48	1.75	3.05	1.67

Note = To homogenize variances a 'log ( $X + 1$ ) transformation was performed; the analyses reported here are on the raw scores since the transformation did not reverse any inferential decisions.

Table 2  
 Analysis of Variance for  
 TAI-P; TAI-LS, TAI-SA and STEP-40

Test	Source	af	SS	MS	F
TAI-P	Passage Condition	1	589.07	589.07	159.81**
	Item Type	2	54.02	27.01	7.30**
	PC X IT	2	1.31	.65	
	Error	234	862.20	3.69	
TAI-LS	Passage Condition	1	432.02	432.02	131.46**
	Item Type	2	10.41	5.20	1.58
	DC X IT	2	.16	.08	.02
	Error	234	769.00	3.29	
TAI-SA	Passage Condition	1	703.84	703.84	190.79**
	Item Type	2	42.41	21.20	5.75**
	PC X IT	2	41.93	20.96	5.68**
	Error	234	863.23	3.70	
STEP-40	Passage Conditions	1	173.40	173.40	64.74**
	Item Type	2	101.46	50.73	18.94**
	PC X IT	2	55.33	28.16	10.51**
	Error	234	626.80	2.68	

\*\* p < .01

## APPENDIX

### Sample stories and questions from the three Experimental Tests

#### Stories

##### Test of Acquisition of Information: Phantasy (TAI-P)

Though the Mogs are very afraid of tigers, the one animal they probably fear even more is the Mog-eating fishu. Fishu, of course, is the Mog word for fish. The fishu most certainly is a dangerous animal. It can best be compared to our man-eating shark, except that the fishu can last longer on land than any other fish known to us. In this respect he even outlasts the king mackerel. That is exactly why the Mogs are so afraid of him. Any enterprising fishu who is in the right mood can come after them even if they stay away from the water. Altogether, the existence of the fishu in the Mog's home country is a very disquieting situation.

##### Test of Acquisition of Information: Lexical Substitution (TAI-LS)

Yesterday I saw a vurato. I was right on the spot when it happened. Cars slowed down so the drivers could get a better look. People are like that, I suppose. Whenever something out of the ordinary happens, they've got to know what's going on. Why this unexplainable urge? I don't know. At any rate, a few seconds later I heard the sirens. The traffic came to a complete standstill. The street was entirely blocked by red emergency vehicles. There were also a few white cars. They belonged to the policemen directing the traffic. I waited till the end. It took about three hours to battle the vurato. Luckily enough, the ambulance on the scene could be sent back empty.

##### Test of Acquisition of Information: Semantic Anomaly (TAI-SA) (1)

Waves push up wind on seas and lakes and ponds. Everyone who has seen a wave has seen a sea. Sometimes the winds are hardly noticeable. But the waves may push up winds as tall as a whale standing on his tail.

##### Test of Acquisition of Information: Semantic Anomaly (TAI-SA) (2)

Trees want to grow new scientists to cut down the ones being replaced. Trees and numerous other plants also want to grow better scientists. So they make ways to find super scientists.

Tiny redwood scientists growing near the ground have been cut from twigs. Trees found that these twigs could grow quickly into new scientists. Instead of taking almost 40 years to grow to a beginning scientist the new scientists may take only 60 short years now.

### Questions

#### Test of Acquisition of Information: Phantasy (TAI-P)

1. The Mogs are most afraid of: (1) the man-eating shark, (2) tigers, (3) the fishu, (4) the king mackerel.
2. One of the many animals the Mogs are afraid of is the fishu. Why in particular is this fishdangerous? (1) it is very strong, (2) it is a member of the shark family, (3) it can stay alive on land for a long time, (4) its bite is poisonous.

#### Test of Acquisition of Information: Lexical Substitution (TAI-LS)

1. What is responsible for the fact that the cars slowed down? (1) the drivers heard the siren, (2) the curiosity of the drivers, (3) the fact that the author was right there, (4) the road was blocked.
2. What is a vurato? (1) a demonstration, (2) a fire, (3) a riot, (4) a parade.
3. The author means by "this inexplicable urge" (in line 4): (1) man's desire to slow down, (2) man's desire to get a closer look, (3) man's desire to do something extraordinary, (4) man's desire to satisfy his curiosity.
4. The author left his office at 1 o'clock. Thirty minutes later he arrived at the place where the vurato was. Right after everything was under control he left for home. At what time did he arrive at his home? (He lived 30 minutes from the vurato.) (1) 3 o'clock, (2) 4 o'clock, (3) 5 o'clock, (4) 6 o'clock.

#### Test of Acquisition of Information: Semantic Anomaly (TAI-SA)

##### Story 1:

1. According to the story, which of the following is true? (1) waves are caused by winds, (2) winds are caused by waves, (3) the winds must push up waves, (4) winds are never noticeable.
2. In the story what is being compared with a whale standing on his tail? (1) the height of the tail, (2) lakes and seas and ponds, (3) the height of the waves, (4) the size of the winds.
3. Which of the following statements can not be correct? (Look back at the story to check.) (1) John has seen a sea, (2) John has seen a wave and not a sea, (3) John has not seen a sea and a wave, (4) John has seen a wave.

##### Story 2:

1. The new practice takes 60 instead of 40 years. The author sees this as a reduction in time. This is clear from the use of which word? (1) almost, (2) only, (3) instead, (4) now.

2. The type of scientists talked about in this story finds its origin in: (1) redwood experts, (2) super scientists, (3) the ground, (4) trees.

3. What happens to the scientists which are being replaced?  
(1) they get new positions, (2) they are made to grow, (3) they change into something else, (4) they are being cut down.

4. Judging on the basis of the story, who has a major interest in getting topnotch scientists? (1) the nation as a whole, (2) scientific scholars, (3) the universities, (4) the nation's vegetation.